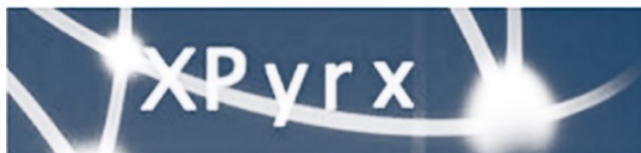# LUIS VON AHN
Trading Card Lesson Plan

BACKGROUND

Luis von Ahn is the inventor of the "CAPTCHA," an automated system that helps computers tell the difference between human users and machines by having people type random sequences of letters and numbers. Luis von Ahn thought there was potential to use these human-generated codes to translate words and pictures so that books could be digitized by having humans re-type words that a computer could not decipher. Luis von Ahn also wanted people worldwide to be able to learn different languages. He developed a method that allowed him to translate language from millions of users on the web. Using the data collected, he developed a language-learning app called Duolingo®.

LESSONS

- A USPTO inventor trading card activity challenge: How does it translate? Luis von Ahn

- The secret code: CAPTCHA and the cipher disk

- Think like a computer: Where is T Markey, Copycat, and Pat Pending?

- Learn a new language: Animal translation

- Invention challenge: Invent a game with a purpose (GWAP)

CURRICULUM TOPICS

Patterns

Computational Thinking

Functions

Translation

Logic

Modular Arithmetic

CONTENT

Mathematics

Computer Science

Foreign Language

GRADE LEVEL

Grades 3-8

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CONTENT STANDARDS

MATH, GRADES 3-8

Operations and Algebraic Thinking

- Identifying arithmetic patterns
- Use rules to generate number patterns

Expressions and Equations

- Writing and evaluating single-variable expressions

Functions

- Defining, evaluating, and comparing functions

Mathematical Practices

- Problem Solving and Reasoning

WORLD LANGUAGES STANDARDS

Communication

- Interpersonal Communication
- Interpretive Communication

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

- Constructing Explanations and Designing Solutions

Disciplinary Core Ideas

- Developing Possible Solutions

Crosscutting Concepts

- Influence of Science, Engineering, and Technology on Society and the Natural World

COMPUTER SCIENCE STANDARDS

Interpersonal Communication

- Data and Analysis
- Impacts of Computing Practices
- Collaborating Around Computing

WHAT IS THE 5E LESSON PLAN?

The 5E lesson plan provides strategic scaffolding to engage students, enhance learning, and assess student learning.

ENGAGE

Pique student interest
Assess prior knowledge

EXPLORE

Collect additional information about the topic

EXPLAIN

Make sense of the concepts and connect to real-world experiences

ELABORATE

Extend learning and apply knowledge

EVALUATE

Formative and Summative Assessments

CONVERGENCE AND TRANSDISCIPLINARY LEARNING

Seamless integration of two or more disciplines is important when trying to teach students how to solve real-world problems.

CONVERGENCE AND TRANSDISCIPLINARY LEARNING

The Federal Government released a report called *Charting the Course for Success: America's Strategy for STEM Education*. The vision of this five-year plan is to build solid foundations for STEM literacy, increase diversity, equity, and inclusion in STEM, and prepare a STEM workforce for the future. One of the pathways to success emphasized in the strategic plan is to engage students where disciplines converge. This lesson plan provides an example of how to implement transdisciplinary learning.

As convergence emerges as a leading research method at the national level, it is essential to consider how it applies to K-12 education.

The images below provide a visual of various approaches to instruction. The USPTO strives to offer materials that model a convergent and transdisciplinary approach to education.

> **"The most transformative discoveries and innovations take place at the junctures where disciplines converge. Discovery and innovation will be catalyzed by an education system that integrates knowledge and methods across STEM, the arts, and the humanities and requires students to ask and answer questions crossing traditional disciplinary boundary lines."**

Charting the Course for Success: America's Strategy for STEM Education. December 2018.

Disciplinary

Students learn the basis of binary code.

Multidisciplinary

Students learn how codes were used to send messages throughout history. Students learn how binary code is used to send computer messages.
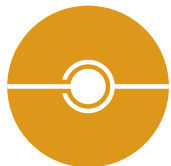
Interdisciplinary

Students learn how data supplied by users can be used to digitize words.

Transdisciplinary

Students create games with a purpose that require combining knowledge from different content areas to solve a humanitarian issue.

LUIS VON AHN
Trading Card Lesson Directions

ENGAGE: A USPTO inventor trading card activity challenge: How does it translate? Luis von Ahn

The ENGAGE section of this lesson will introduce Luis von Ahn's work and his patents for CAPTCHA technology.

➔ **TIME:** 40 minutes

➔ **MATERIALS:**

- A USPTO inventor trading card activity challenge: How does it translate? Luis von Ahn
- Colorful letter beads
- Elastic cord or chenille stems
- Dog and cat beads (grades K-3)
- Print cards with dog and cat spelled in different languages
- Safari animal beads (Grades 4-8)
- Print cards with safari animals spelled in different languages

➔ **BACKGROUND:**
Students select an animal (dog or cat for Grades K-3 or a safari animal for Grades 4-8) and create a translation bracelet according to the directions in the Trading card activity sheet.

➔ **INSTRUCTIONS:**
Explain in basic terms what a patent is, and that Luis von Ahn and other inventors received a patent for creating a method that ensures that a human, not the computer, is logging into a website. Students complete the trading card activity: "A USPTO inventor card activity challenge: How does it translate? Luis von Ahn" and complete the "Make a translation bracelet."

➔ **STUDENT ACTIVITY HANDOUT:**
A USPTO inventor card activity challenge: How does it translate? Luis von Ahn

EXPLORE: The secret code: CAPTCHA and the cipher disk

The EXPLORE section of this lesson plan engages students in how a code can be used to secure communication.

➔ **TIME:**
40 minutes

➔ **MATERIALS:**

  – Mini CD tray
  – Standard CD case
  – Print the cipher disk template
  – Scissors
  – Tape
  – Glue

➔ **BACKGROUND:**
Codes have been crucial for over 4,000 years and have been used to protect national secrets, dignitaries, and kings for centuries. Now codes are essential for protecting personal and financial information accessed on computers and for national security.

➔ **INSTRUCTIONS:**

  – Read and discuss Luis von Ahn's background information with students.
  – Have students watch: Luis von Ahn's Captcha and reCAPTCHA - NOVA ScienceNow
  – Students complete the activity "The secret code: CAPTCHA and the cipher disk."

  Answers for Quote Decoding:

    "Only in the darkness can you see the stars."

    "Reacting in anger or annoyance will not advance one's ability to persuade."

➔ **STUDENT ACTIVITY HANDOUT:**
The secret code: CAPTCHA and the cipher disk

Acknowledgement: Inspired by and with permission from the Resource Area for Teachers.

EXPLAIN: Think Like a Computer:
Where are T Markey, Copycat, and Pat Pending?

The EXPLAIN section of this lesson plan engages students in how computers work. Students must understand that all computers take in information or input, store the data, process it, store it again, and output the results. Computers do this through electrical signals through a system called binary code.

→ **TIME:**

40 minutes

→ **MATERIALS:**

- Direction sheet
- Data collection sheet and printed stickers
- A picture with USPTO characters

→ **BACKGROUND:**

This lesson provides students with a simulation of how Luis von Ahn's CAPTCHA was used to collect user data. The CAPTCHA technology ensures that computer users are human and allows people to access secure websites. By typing CAPTCHAS, users provided data to label images on the internet.

Students can view videos that explain how computers input, store, and output data on Code.org at:

- [How do computers work? What Makes a Computer, A Computer?](#) (5:10 min.)
- [How do computers work? Binary & Data](#) (5:59 min.)

→ **INSTRUCTIONS:**

- Students will color T-Markey, Pat Pending, and Copycat on the image on page 2. This activity simulates the clicks on CAPTCHA images when a person accesses a secure website.
- The teacher will explain intellectual property (IP) and each character's IP type. Provide examples of a trademark, patent, and copyright.
- Students complete the activity, "Think like a computer: Where is T Markey, Copycat, and Pat Pending?"

You can find more information at [uspto.gov/kids](#).

→ **STUDENT ACTIVITY HANDOUT:**

Think Like a Computer: Where are T Markey, Copycat, and Pat Pending?

ELABORATE: Learn a new language: Animal translation and invention challenge: Invent a game with a purpose (GWAP)

The ELABORATE section of this lesson plan enables students to learn about a new language and understand how Luis von Ahn created a game that led to his development of a language-learning app called DUOLINGO®.

→ **TIME:**
80 minutes

→ **MATERIALS:**

- Learn a new language: Animal translation
- Print four copies of each of the animal coloring pages (class of 24)
- Print animal stickers in the language of your choice (Spanish, French, or Navajo) onto address labels sized 1¾" x 4" or laminate for reuse. (Avery labels number 5162)
- Print answer keys (Spanish, French, or Navajo) for each pair of students assigned the same animal. You may want to laminate these for reuse.

→ **BACKGROUND:**
Luis von Ahn believed that if he developed games with a purpose (GWAP), he could continue to capitalize on human efforts to create new programs that benefit humanity. Luis von Ahn grew up in Guatemala, where he had access to an excellent education. He quickly realized that not everyone in Guatemala or the world has access to the same education. He felt that knowing English would give them more excellent opportunities. His goal was to develop a free app that allowed people to learn different languages and solve the problem of educational inequities around the world.

→ **INSTRUCTIONS:**
Students play a simulated game with a purpose called "Learn a New Language: Animal Translation." Students choose a picture of an animal and work with another student who has chosen the same animal. Teachers can limit the number of animal coloring pages for all animals. Select a language and an animal to display. Review the animal parts in the chosen language.

1. Students sit across from their partners but work on their own, at first, to label the parts of the animal using stickers or laminated cards to label parts of the animal. The teacher predetermines the language used.

2. After completing individual work, each student will compare answers with their partner. Students revise their work and come to a consensus.

3. Distribute an answer card to each pair of students.

4. Each team gets one point for each correct answer and colors the parts of the animal they labeled correctly.

5. Students post their pictures on the board and provide explanations to the class.

6. The teacher explains that if fewer than ten drawings have a specific part colored (i.e., legs), the computer wouldn't be able to learn that word. If ten or more different teams correctly label a body part, the computer knows a new word for that body part.

7. Students complete the activity "Invention challenge: Invent a game with a purpose (GWAP)." They invent their own game with a purpose that enables them to gather information to do something good for people or animals.

→ **STUDENT ACTIVITY HANDOUTS:**

Learn a new language: Animal translation

Invention challenge: Invent a game with a purpose (GWAP)

EVALUATE: Lead a discussion or create a journal reflection with students

Use the following questions to guide student discovery and connections to the inventions of Luis von Ahn:

1. Why is it important to have encryption on the internet?

2. What is the role of humans in each of these activities?

3. What do these activities have to do with Luis von Ahn's inventions?

VOCABULARY

CAPTCHA

Completely Automated Public Turing test to tell Computers and Humans Apart

TURING

A test of the computer's ability to interpret information through mathematics and named for the British mathematician responsible for creating a machine that deciphered German codes during WWII.

ReCAPTCHA

A CAPTCHA system that makes it easier to distinguish between humans and automated access systems. The second version asked users to decipher the text, and the current version runs automatically.

BINARY CODE

A two-symbol system represented by 0s and 1s (base 2) that provides computer instructions for text, data, or processing.

GWAP

A game with a purpose is a method used to generate data from human-computer users that can be used to help humanity.

INTELLECTUAL PROPERTY

Creations of the mind that may include but are not limited to inventions, written, artistic, and design works. These may be protected by acquiring a patent, trademark, copyright, or trade secret.

PATENT

An exclusive property right granted by the United States Patent and Trademark Office to inventors to make, use, or sell their inventions within the United States for a limited period.

TRADEMARK

A word, name, symbol, or design that is used in trade to indicate the source of the goods and services and to distinguish them from the goods and services of others.

COPYRIGHT

A form of protection provided to the authors of "original works of authorship," including literary, dramatic, musical, artistic, and certain other intellectual works, both published and unpublished.

TRADE SECRET

Information that has either actual or potential independent economic value by not being generally known, has value to others who cannot legitimately obtain the information, and is subject to reasonable efforts to maintain its secrecy. For example, the formula for Coke® products.